

THE INVENTION CLAIMED IS:

1. A method for planarization of ILD layers on a semiconductor wafer comprising:

providing an oven having a wafer holder provided therein ;

5 placing the semiconductor wafer on the wafer holder;

applying mechanical pressure to the ILD layer on the semiconductor wafer using a mechanical device; and

applying heat to the ILD layer on the semiconductor wafer using the mechanical device simultaneously with the applying the mechanical pressure.

2. The method as claimed in claim 1 wherein:

applying the mechanical pressure includes providing relative motion between the mechanical device and the ILD layer on the semiconductor wafer to assist in planarization.

3. The method as claimed in claim 1 wherein:

applying the mechanical pressure includes providing non-sticking motion and transferring heat between the mechanical device and the ILD layer on the semiconductor wafer to assist in planarization.

4. The method as claimed in claim 1 wherein:

applying the heat includes sensing and controlling the temperature of the mechanical device.

5. The method as claimed in claim 1 wherein:

applying the mechanical pressure uses a top plate as part of the mechanical device.

6. The method as claimed in claim 1 wherein:

applying the mechanical pressure uses a roller as part of the mechanical device.

25 7. A method for planarization of low dielectric constant ILD layers on a semiconductor wafer comprising:

providing an oven having a rotatable wafer holder provided therein ;

placing the semiconductor wafer on the wafer holder;

rotating the wafer holder with the semiconductor wafer thereon;

spinning on the low dielectric constant ILD material on to the semiconductor wafer in the oven;

soft baking the low dielectric constant ILD material at a soft bake temperature in the oven;

holding the low dielectric constant ILD material at a temperature below the hard back
temperature in the oven;

applying mechanical pressure to the ILD layer on the semiconductor wafer using a
mechanical device to apply rotating pressure to the ILD layer in the oven;

applying heat to the ILD layer on the semiconductor wafer through the mechanical
device simultaneously with the applying the mechanical pressure in the oven;

hard baking the low dielectric constant ILD material at a hard bake temperature in the
oven;

cooling the low dielectric constant ILD material in the oven; and

annealing the low dielectric constant ILD material in the oven.

10 8. The method as claimed in claim 7 wherein:

applying the mechanical pressure includes providing traverse motion between the
mechanical device and the ILD layer on the semiconductor wafer to assist in
planarization.

15 9. The method as claimed in claim 7 wherein:

applying the mechanical pressure includes providing non-sticking sliding motion and
transferring heat between the mechanical device and the ILD layer on the
semiconductor wafer to assist in planarization.

20 10. The method as claimed in claim 7 wherein:

applying the heat includes infrared sensing and controlling the temperature of the
mechanical device through a phase lock loop temperature control.

11. The method as claimed in claim 7 wherein:

applying the mechanical pressure uses a rotating and transversely moving top plate as
part of the mechanical device, and

25 applying the mechanical pressure is applied to cause reflow of the ILD layer.

12. The method as claimed in claim 7 wherein:

applying the mechanical pressure uses a rotating and transversely moving roller as
part of the mechanical device, and

applying the mechanical pressure is applied to cause reflow of the ILD layer.

30 13. The method as claimed in claim 7 wherein:

holding the low dielectric constant ILD material at a temperature below the hard back
temperature in the oven holds the temperature between 100°C and 400°C; and
exhausting volatile gases from the ILD material from the oven.

14. The method as claimed in claim 7 wherein:
applying mechanical pressure uses a mechanical device having a consumable surface
in contact with the semiconductor wafer.
15. An apparatus for planarization of ILD layers on a semiconductor wafer
comprising:
an oven;
a wafer holder provided in the oven; and
a mechanical device for simultaneously applying mechanical pressure and heat to the
ILD layer on the semiconductor wafer.
16. The apparatus as claimed in claim 15 wherein:
the mechanical device includes a mechanism for providing relative motion between
the mechanical device and the ILD layer on the semiconductor wafer to assist
in planarization.
17. The apparatus as claimed in claim 15 wherein:
the mechanical device includes a mechanism for providing non-sticking motion and
transferring heat between the mechanical device and the ILD layer on the
semiconductor wafer to assist in planarization.
18. The apparatus as claimed in claim 15 wherein:
the mechanical device includes circuitry for sensing and controlling the temperature
of the mechanical device.
19. The apparatus as claimed in claim 15 wherein:
the mechanical device includes a top plate for applying mechanical pressure.
20. The apparatus as claimed in claim 15 wherein:
the mechanical device includes a roller for applying mechanical pressure.